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Directions for the construction of an improved Mountain Barometer. by C. T. Jackson M.D.

A

First ~~I shall~~ he describe ~~the construction~~ of the Cistern. The compositor must change the first person in this paper to the third

~~There is no haste as to the publication of this & you may merely give a notice of it as you please &c.~~

This should be made of a clear glass cylinder 1½ inches in diameter & 1½ inches high. It is to be ground on an iron plate with fine washed emery so that the ~~cap~~ head & bottom pieces will fit accurately -

The head may be made of well seasoned box wood or of cast iron or steel. It should have a shoulder to rest on the head of the cylinder while it must also fit within it accurately. A neck is to be left in turning the head & a female screw cut within it affords a ready means of adjusting the ~~glass~~ tube which is to have a box wood or iron screw cemented upon it to fit the neck above mentioned. The joints are all to be secured by waxed leather washers -

The bottom of the glass cylinder is to be furnished with a box wood or cast iron ring to which the ~~b~~ kid bag for elevating & depressing the mercury is to be attached. This is fixed to the cylinder in the same manner as the head by means of leather washers covered with a thick solution of shell lac in alcohol & bound together by three screws which pass through the brass cap & supporting ring -

The last mentioned ring has three projections for the binding screws to enter. It covers & presses up the bottom piece so as to make the joint tight

The kid bag is attached by means of waxed sadlers silk & a little gum tragacanth to the bottom piece & a plug is to be tied into the centre of the bag so as to carry it up steadily on turning the elevating screw. This plug is made to fit loosely into the space in the bottom ~~piece~~ - Its use is to elevate ~~&~~ or to lower the mercury at pleasure

~~[illegible]~~ To the lower part of the binding ring ~~[illegible]~~ a brass cylinder or truncated inverted cone is screwed & through the bottom of this passes the elevating screw terminated with a flat disk or button to press ~~up~~ against the plug while at the other end is an ivory or brass milled head for turning the screw which passes through the bottom of the ~~cup~~ cone containing the kid bag -

The cap or brass cover of the cistern has projections with openings for the screws to bind the top & bottom pieces together by means of three binding ~~[illegible]~~ screws. This cap has a neck covering that of the head of the cistern & in this neck is a female screw into which the brass tube containing the barometer tube is to be fixed -

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The brass tube consists of two pieces, the lower being the largest, while the upper part is made with a long slit or ~~[illegible]~~ window open ~~part~~ on ~~both sides~~ opposite sides of the tube. On account of this a set of rings or braces is to be inserted within this inside tube to support its sides. These are ~~soldered~~ riveted to two strips of brass & may be moved up & down as may be required during an observation -

The upper tube requires the finest finishing as it has to bear the graduation - The tube should be very hard & fine that "drawn on a pin" is the best. It is fitted by means of a screw & shoulder to the lower tube. The top of the upper tube is to be terminated by a bell metal cap ~~being~~ with a swivel joint bearing a ring for suspension of the instrument during an observation -

The Vernier is made of brass & slides over the upper tube guides keeping it ~~in~~ in place in the slits. It moves ~~by~~ easily & steadily on the tube & requires no clamping or tangent screws. It is graduated on both sides on the right it ~~gives~~ marks the $\frac{1}{100}$s or $\frac{1}{1000}$s of an inch on the english scale & on the left the tenths of millimetres on the french scale. The ring, at the top of the vernier ~~at~~ is during observations, brought to the top of the mercurial column in the glass tube & the graduation is read off on both sides by means of the two verniers - If the tube is $\frac{1}{5}$ of an inch bore the mercury will be sensibly plane or only a very slight meniscus will be perceived. ~~It can always~~ which may be measured by bringing the vernier first to form a tangent to its curved surface & then with the base of it, where it comes in contact with the glass- It is customary to measure always from the top of the meniscus.

~~There fo~~

In the top of the cistern a steel screw armed with an ~~ivory~~ point is fixed so that the point shall form the zero of the instrument when it touches the surface of the mercury-

Through the centre & side of this screw ~~[illegible]~~ is an opening for admission of the air to the surface of the mercury during ~~an~~ observation. It is closed by a smaller steel screw with a milled head, after the observation has been made & the mercury elevated to the top of the cylinder. If preferred, this opening for admission of air may be made in the opposite side of the cistern head, & it may be ~~made~~ large enough to add mercury from time to time as may be needed, to supply the loss sustained by accidental leakage.-

The Glass tube for a barometer should be made of the finest kind of white glass & may be of $\frac{1}{5}$ or $\frac{1}{6}$ of an inch bore & from $\frac{1}{16}$ to $\frac{1}{20}$ of an inch in thickness. It ought to be a true cylinder, but if slightly conical as is usually the case, it is of no importance in the kind of barometer here described, though this irregularity of the bore, would ~~to~~ unfit the tube for the iron ~~cistern~~ or wooden cistern barometer, where the capacity of the tube & of the cistern must be accurately known, in order to make proper corrections for the alteration of the zero point in the cistern, by rise or depression of the mercury. ~~of the tube~~ -

The ~~glass~~ tube should be well annealed, and closed up at both ends, at the glass house —

Having procured ~~the~~ tubes, we have next to ~~fill the~~ prepare, & fill them, with mercury-

The tube is selected, & it is to be tried ~~into~~ in the brass frame work, to see if it will fit well.-

Then one end of it is to be melted & drawn off before the flame of a table ~~bl~~ blowpipe, or over one of my air blast lamps - ~~[illegible]~~ That end of the tube is then to be melted until it is of uniform thickness, & hemispherical, or rounded evenly.- ~~It is~~ After which it should be allowed to cool very gradually, so as to be perfectly annealed.-

Having determined on the required length of the tube, say 35 inches, it may be cut off to ~~of~~ that length, by means of a mark made with a sharp file, & gently drawing the tube ~~apart~~ asunder in the act of breaking it off - Next draw the end of the tube to a conical form, taking care not to let the flame of the blowpipe or lamp play into the open end, lest moisture or smoke should be deposited in it. – ~~[illegible]~~ The mouth of the tube should be left open sufficiently for the ready introduction of the mercury –

It being now ready for filling, ~~first~~ after the mercury is prepared, & warmed & the air pump is ready, we may first heat the tube throughout by holding it over ~~the~~ a ~~[illegible]~~ charcoal fire, made in a pot furnace

Then take a very fine tube funnel, & pour into the barometer tube about 6 inches of mercury & shake out any air bubbles that may be ~~[illegible]~~. Then connect the tube with the air pump, by means of a flexible ~~tube~~ hose lined with a coiled steel [illegible] wire, & having a brass tube attached to its extremity, with a perforated waxed cork, for ready adjustment & removal of the barometer tube, during the operation. –

Work the pump until a vacuum is obtained, & then heat the mercury in the barometer tube until it boils freely, holding it at an angle of 10 or 20 degrees during the operation & driving all the air bubbles out from the mercury. – Continue to work the pump during the boiling, until you are satisfied that the ~~tube is [illegible]~~ air is all expelled – Then remove the tube, & add about 8 inches more of boiling hot mercury to it, & adjusting the ~~tube~~ it to the air pump proceed to boil the mercury

that was introduced, beginning below it & proceeding upwards. – When this is done, add more hot mercury, & continue the operations as before described, until the tube is filled to within two or three inches of the open end. Remove the tube now, & fill the ~~[illegible]~~ remainder of the space with hot mercury, by means of a fine glass tube funnel, made by drawing a piece of barometer tube ~~in the~~ to a fine hair – Fill this little funnel, & while the mercury is streaming ~~from~~ it, plunge it into the tube, below the level of the mercury already there, & it will fill the tube without including any air bubbles. – ~~So~~ It is ~~best to~~ well however, to boil this mercury also, to be sure that there is no included film of air, & it is easily done if ~~[illegible]~~ the tube is left longer than is required. – When the filling is completed, & the tube cooled, the excess of the tube may be cut off & the extremity of it may be softened with the blowpipe & turned (on) one side, at right angles, that form being the best to secure the ~~[illegible]~~ vacuum in the tube. ~~[illegible]~~ ~~[illegible]~~ ~~if it is not~~

~~If the [illegible]~~ If the cistern is ready the tube may ~~[illegible]~~ be ~~[illegible]~~ cemented into its ~~[illegible]~~ screw ring, & fixed into its place. ~~[illegible]~~ The tube being kept always inverted the brass tube may be screwed in, & all the parts of the instrument arranged. – Then the cistern may be filled by laying the instrument horizontally on the table & taking out the Screw in the ~~top~~ ~~of the~~ head of the cistern, a bent tube funnel ~~is to be~~ being introduced, & the mercury poured in, until it is nearly over the mouth of the tube; warm the upper part of the Barometer, until the mercury oozes out from the orifice, then complete the filling of the cistern, relaxing the Screw at the bottom, to allow sufficient mercury to enter, so as to be sure to cover the mouth of the tube – Then ~~put the~~ remove the funnel & replace the Screw in the head of the cistern. – Screw up the mercury to the top of the cistern & then hang up the Barometer, thus completed, open the air tube, as you lower the mercury to the ivory point.

The mercury will probably adhere to the top of the tube, especially if it is of small bore; rap it lightly & it will descend –

Adjust the mercury to the zero point, & see that you have a sufficient supply in the cistern. – The instrument is now done & you have next to ~~fix~~ affix the attached thermometer, which ought to be graduated to the centigrade, & Fahrt Scales, on opposite sides – The best thermometers are those with cylindrical bulbs, which should be of the same diameter with the Barom tube.

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& ought to be protected by a brass cover on the exterior, while the under side should communicate with the space around the Barom tube, by means of an ~~for~~ openings in the brass tube – The best place for the attached Thermometer, is below ~~the~~ the top of the lower brass tube, or near ~~in~~ the centre of the instrument.

It is of no use to place a thermometer in the cistern =

Preparation of the Mercury

~~Pure~~ Pure distilled mercury is to be used in filling both the tube & cistern of the Barometer & the traveller should ~~also~~ have a small stock of it on hand to replenish the cistern if any considerable loss should take place by leakage – With care this may be in a great measure avoided –

The Mercury should be distilled by the operator, for no dependance can be placed on that sold in the shops. – ~~This~~ It is easily ~~done~~ distilled in a small ~~retort~~ clean retort of glass over a good Chemical lamp or a Charcoal furnace – The distilled mercury may be caught in a ~~[illegible]~~ clean dry phial placed over the neck of the retort –

It is ~~also~~ mixed with a considerable quantity of blk oxide of mercury & must be cleansed of it by repeatedly shaking it violently & straining it off through an artificial Horizon box or by means of a glass tube projecting ~~through~~ the cork of the phial a quarter of an inch, while another runs quite through to its bottom. On inverting the phial, the clean mercury will pass out & leave the oxide in the phial — The operation must be repeated many times, until no film of oxide is seen on the surface of the metal. — Acids should never be used to cleanse mercury for Barometers or Thermometers, for any acid or its salts remaining in it would spoil the instruments. ~~filled with [illegible]~~

I should advise every Geologist and Engineer to prepare his own barometers ~~if~~ or to superintend in person every operation of the instrument maker who may be engaged ~~to~~ in constructing them; for a bad instrument is a source only of vexation & disappointment ~~from which I have so frequently suffered~~ ~~that~~ while a good one will give results that may be relied upon with confidence #.

~~C. T. Jackson~~

# ~~Boston March 14th 1845~~

P.S. The above described Barometers ~~is now~~ are admirably constructed by Mr J. W. Temple Philos. Instrument maker Court Street Boston.

Jackson Charles Thomas

1805 – 1880

M.a.s. 10p. 4° Boston 14.III.1845.

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